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ANIMAL PSYCHOLOGY AND CRITERIA OF THE PSYCHIC[1]

IN the brief discussion of criteria of consciousness which follows it has been my purpose to distinguish between the philosophical and the naturalistic attitudes toward such criteria, to arrange systematically those criteria which are already in use, and to call attention to certain aspects of the values of various signs or tests of mental life. I have nothing new in either material or method to contribute to the subject, but I do wish to emphasize the importance in comparative psychology of the use of all available signs or criteria of mind rather than the selection of any one as the sufficient and final proof of consciousness. Whatever justification this discussion may need will have to be found, therefore, in the fact that it brings together a number of well-known facts which seldom are considered collectively in their relations to the study of psychic processes.

Quite apart from philosophical arguments concerning the nature of consciousness, and the epistemological or logical implications of the concept, the natural scientist is able to search out and make use of certain signs of mental life which he recognizes as criteria of consciousness. The logician in his attitude toward these criteria is chiefly concerned with their relations to the large number of concepts which constitute for him a self-consistent system; he is interested in what is necessarily true on the basis of certain assumptions. The naturalist is concerned with the practical validity of his inferences; he deals with a narrower range of relationships than the logician. The logician studies the necessary forms of criteria; the naturalist notes whether certain signs, which he has discovered by observation, serve as satisfactory guides for action. One asks 'must it be true'? the other asks, 'does it work'? Let me illustrate my meaning by reference to the positions taken by two well-known thinkers. Münsterberg,[2] with his avowed purpose to satisfy the demands of a logical system, holds that 'acknowledgment' is our only criterion of consciousness in the brutes. By this he means that only those

[1] Criteria is used here in the sense of signs or tests, rather than proofs.

[2] 'Grundzüge der Psychologie,' Bd. I., S. 98–99.

animals are conscious which we treat as conscious beings. Loeb,[3] from an entirely different position, which I should call the naturalistic in contrast with the philosophical position of Münsterberg, asserts that evidence of ability to profit by experience is the criterion of associative memory, which in turn is the criterion of consciousness.

The logician and the naturalist do not necessarily disagree in their definition of consciousness; for both it may be the subjective, individual fact, which can be known directly only by the individual whose experience it helps to constitute, and who, in turn, is constituted an individual by the totality of states which are spoken of severally as states of consciousness. For the natural scientist this subjective fact is material of science because it can be studied in its relations to the facts of anatomy, physiology, anthropology. Human purposes well may be material of science, albeit we know only our own directly; and in precisely similar fashion the mental life of an insect, a fish or a monkey may be studied indirectly. In all these cases we have to depend upon inferences. We carefully note the order of physical (more exactly physiological) and psychic events in the individual, and then, on the basis of similarity of the physical order in another individual, we infer similar psychic processes. Certainty of the truth of these inferences there is none, nor can there be; but neither is there certainty of the truth of any of our inferences concerning the states of consciousness of our fellow beings. I infer that you are conscious; can I ever be more than practically certain of it? Here, if anywhere, we see the striking difference between logical and practical certainty. The former is that which satisfies the rational mechanism; the latter is that which suffices for the guidance of action. A moment's consideration, and we are convinced that inference plays a far more important rôle in human life than is usually suspected. In all things we make use of signs. Inference is the framework of science. Take from the natural scientist all that he does not know directly, all that he accepts with no more than practical certainty, and he is left with a colorless consciousness which can not even be described as self-consciousness. The criteria or signs upon which our scientific inferences rest are selected according to their serviceableness; they survive, as the pragmatist would say, because inferences based upon them are satisfactory determinants of action.

Wherever inference is necessary in thought it is desirable to study its basis; nowhere is this more important than in connection with consciousness. It is therefore worth our while to examine carefully the group of signs which have been selected by psychologists and physiologists as criteria of consciousness in order to learn

[3] 'Comparative Physiology of the Brain and Comparative Psychology,' p. 218.

whatever we may concerning their values. It should be noted at once that all of the criteria proposed apply as well to human consciousness as to that of the brute, for too often we think that whereas we know human consciousness fairly well that of lower animals is quite beyond the limits of our knowledge. Now, as a matter of fact we know both by inference; hence, the only difference in our knowledge of the two is due to the somewhat greater perfection of our ability to apply our criteria in case of man. That you are a human being is no more proof that your consciousness is the same as that of your companion than is the fact that you have eyes similar to his proof that you see colors as he does. Consciousness must always be indirectly known, except in introspection; consequently our knowledge of the mental life of animals must vary, for all practical purposes, with our knowledge of their anatomy, physiology, habits, instincts and reactions.

Roughly, the signs of the psychic, which seem to me worthy of constant use, may be classified as the structural and the functional. From structure we infer the possibility of certain modes of behavior; and behavior is accepted as evidence of certain structural conditions. Both serve as signs of consciousness. In all cases in which mental life is in question, man serves as the basis of comparison.

I present the following six criteria in what seems to me in general the order of increasing importance. The functional signs are of greater value as a rule than the structural; and within each of the categories the particular sign is usually of more value than the general. In certain cases, however, it might be maintained that neural specialization is of greater importance than modifiability.[4]

I. *Structural Criteria.*

1. General form of organism. (Organization.)
2. Nervous system. (Neural-organization.)
3. Specialization in the nervous system. (Neural-specialization.)

II. *Functional Criteria.*

1. General form of reaction. (Discrimination.)
2. Modifiability of reaction. (Docility.)[4]
3. Variableness of reaction. (Initiative.)

In parentheses I have suggested single words for the designation of these criteria. The terms 'discrimination,' 'docility' and 'initiative' have been taken from Royce's[5] excellent discussion of the

[4] Modifiability, as here used, includes the several types of learning which are usually distinguished as unconscious (?) adaptation, associative learning, imitative learning and rational learning.

[5] 'Outlines of Psychology,' pp. 20–57.

physical signs of mind in his text-book of psychology. Inasmuch as we speak of these criteria as physical signs of mind, it has seemed to me preferable to use language which was free from implication of the psychic; for this reason I use modifiability and variableness rather than docility and initiative.

Suppose, now, for the purpose of defining our criteria in more practical detail, we attempt to apply them to some organism of simple development—say, the sea anemone. (1) The general *organization* of the animal is so strikingly different from our own and from that of any other organism which we acknowledge as intelligently or rationally conscious that we are unable to give positive value to this test. It is true, however, that although similarity of form is presumptive evidence of similarity of function and of psychic processes, structural difference does not necessarily involve psychic difference. (2) No more satisfactory basis of inference is furnished by the *neural organization* of the sea anemone, for the nervous system is not sufficiently similar in form to those of undoubtedly conscious animals to warrant inference. (3) And finally, on the structural side, of *neural specialization* there is far too little to justify inference of more than mere sentiency. It must then be admitted that the structural criteria do not furnish a basis for the inference of anything except the lowest grade of consciousness.

Passing now to the functional criteria: (1) We find, as the neural specialization would lead us to expect, a number of differentiated reactions. *Sensory discrimination* appears as an important feature of the life of the organism. In fact there is evidence of both of Royce's discriminative signs: 'feeling' (liking and disliking), and different types of sensory disturbance, for the animal reacts differently to difference in quality of stimulation, as well as to difference in intensity. There is in this a slight sign of adaptation which may or may not prove to be in some degree intelligent. (2) But thus far there have been no careful studies of the *modifiability* of the reactions of the sea anemone. As a matter of fact, the observations of the animal under natural conditions have furnished no evidence of any form of ability to profit by experience; yet it would be foolish to conclude that the animal can not learn, for a systematic study of the subject in all probability will demonstrate the existence of modifiability of the associative type. (3) With *variableness* the case is similar, for too little work has been done to enable one to say much with assurance. So far as observed, the animal's reactions are uniform, there is no indication of sudden, apparently spontaneous, adaptation to the demands of situations. In other words, there is no sign of mental initiative.

As a result of this application of our criteria we should have to

say that the sea anemone probably possesses consciousness of the sensory-discriminative grade, but that there are no signs of either intelligent or rational consciousness.

This distinction which I have thus made of three grades or levels of consciousness—the discriminative, the intelligent and the rational—leads us directly to the consideration of the relative values of the three functional criteria, for it will be noticed at once that each of the three criteria corresponds to one of the grades of consciousness.[6]

By a number of investigators ability to profit by experience has been used as the all-sufficient criterion of mental processes. That the use of this criterion alone is undesirable, or even absurd, needs no further proof than that some form of modifiability or ability to learn is a characteristic of protoplasm. The more highly organized, the less stable the organic substance, the more readily it is modified by environing conditions it would seem. Hence, unless one is ready to start with the assumption that consciousness itself is a property or accompaniment of protoplasm (in which event there is no need of criteria of the sort we are discussing) this criterion is valueless when used alone. The fact that the crayfish needs a hundred or more experiences for the learning of a type of reaction that the frog would learn with twenty experiences, the dog with five, say, and the human subject with perhaps a single experience, is indicative of the fundamental difficulty in the use of this sign. Animals differ in rapidity of learning, but it has not been shown that any organism exists whose reactions can not be modified in adjustment to environmental conditions. We find marked differences in permanency of modifications among organisms, as well as in rapidity of adjustment. Moreover, several kinds of modifiability may be distinguished. But this involves us in a difficulty, for although one might naturally expect that animals differ merely in degree of docility, many students of the subject see fit to maintain that there are differences in kind as well as in degree.

Loeb, for example, accepts associative memory as the criterion of consciousness, and then adds, quite safely, "The criteria for the existence of associative memory must form the basis of a future comparative psychology. It will require more observations than we have made at present to give absolutely unequivocal criteria." So far we can agree and in part sympathize with him, but he goes on to commit himself to what we may call the assumption of a critical point—"For the present we can say that if an animal can learn, that

[6] The three grades of consciousness here mentioned correspond very closely, I believe, to Morgan's sentiency, effective consciousness, and self-consciousness. See Morgan's 'Animal Behavior,' pp. 42 ff.

is, if it can be trained to react in a desired way upon certain stimuli (signs), it must possess associative memory.'"[7] To say that animals exist which can not be trained to react in a desired way upon certain stimuli implies that modifiability is not a characteristic of protoplasm. If protoplasm is not always modifiable, which I do not grant, there must be a critical point in organic development at which Loeb's 'ability to learn' becomes possible. Now it is this assumption that some animals can not learn that appears unwarrantable. In the first place experience teaches us that animals do learn, and we therefore treat them as if they could until we are convinced that they can not (this is the purely practical aspect of the situation). No organism, I believe, has thus far been proved incapable of profiting by experience. The burden of proof rests with those who assume that only certain animals can learn, for it would be far more reasonable to ask for a demonstration of the inability of some one organism to profit by experience than to demand that the docility of all animals be proved. But of far greater importance for the support of our contention are the positive facts. Omitting mention of the well-known facts of modifiability in more complex organisms, we may refer at once to the evidences of modifiability in unicellular organisms.

Jennings, in a series of investigations remarkable alike for their admirable scientific character, their value and interest, has shown that the behavior of certain of the unicellular organisms is complex and modifiable. *Stentor,* for example, exhibits several forms of reaction, and also adaptation to conditions.[8] Further evidences of what Jennings himself considers incipient intelligence in lower organisms are presented in his recent volume of studies.[9] In this volume he writes, "Memory has as its basis the general phenomenon that a stimulus received or a reaction performed leaves a trace on the organism, or modifies its conditions in such a way that it later reacts differently to the same stimulus. This basis of memory is, of course, clearly present in *Stentor*" (p. 126). And again, "This [referring to a series of reactions in *Stentor*] is clearly the method of trial and error passing into the method of intelligence, but the intelligence lasts for only very short periods. To really modify the life of the organisms in any permanent way, as happens in higher animals, the method of reacting discovered to be successful by the method of trial and error should persist for a long time. Apparently this is not the case for unicellular organisms, but further work is needed on this point" (p. 251).

[7] 'Comparative Physiology of the Brain and Comparative Psychology,' p. 218.

[8] Jennings, 'American Journal of Physiology,' 1902, VIII., pp. 42 ff.

[9] Jennings, 'Contributions to the Study of the Behavior of Lower Organisms,' published by the Carnegie Institution of Washington, pp. 112, 126, 251.

It is furthest from my purpose to argue in opposition to Loeb that there are no crises in organic development; on the contrary, I should admit that it is practically certain that sudden changes do occur, that Nature does make leaps, that gradual development in one direction suddenly makes possible some apparently new process of change. But mere ability to learn, as defined by Loeb, what is called modifiability in this paper, is not, so far as I can determine, something which appears suddenly as a mark of a critical point in organic development. I wish to maintain that Loeb makes a mistake in his choice of a criterion, that he should lay stress upon the manner of learning instead of upon the mere fact of learning. Associative memory is a particular kind of modifiability; hence, although it implies modifiability, modifiability of reaction does not necessarily imply associative learning. If this be true we should study the way in which animals learn, determine the various modes of profiting by experience, classify them, and thus ascertain not merely which animals learn or even which learn associatively, but also precisely how they learn.

On the basis of the studies of animal behavior which are now on record we may safely say that mere ability to learn is common to all animals, and that it is indicative of a low grade of consciousness; ability to learn associatively, on the other hand, is restricted to certain animal phyla and is a sign of a higher grade of consciousness. This is in disagreement with Loeb, for he holds, first, that associative memory is *the* criterion of consciousness, and, second, that ability to learn is *the* criterion of associative memory. In contrast with this I wish to defend the view that ability to learn is *a* criterion of consciousness, and that the different kinds of learning (associative, imitative, rational) which we distinguish are criteria of different grades of consciousness. There is no one criterion of the psychic which can be accepted as a sign of all forms and conditions of consciousness. Each grade of mental development has its own appropriate signs or criteria: discrimination indicates a less complex form of psychic processes than associative learning, and this in turn is a sign of a lower grade than that which is indicated by inventiveness or initiative or variableness of reaction. If a single criterion is imperatively demanded we might agree to accept rapidity of learning as a measure of the complexity of the psychic.

With these few thoughts concerning the theoretical aspects of the problem of criteria clearly in mind, let us examine for a moment the practical application of ability to learn as a criterion. Bethe, as well as Loeb, selected this as the one available and sufficient criterion, and, fortunately for our purposes, he has through his experimental

work furnished us with results of its application that may now be taken as indications of its serviceableness.

After a study of the crab, in the course of which it was shown that five or even more experiences(!) did not enable the animal to learn to avoid a dangerous object, Bethe concluded that the animal does not possess psychic processes.[10] In similar fashion he made experiments with ants and bees which convinced him that these animals are merely reflex machines, incapable of profiting by experience, and therefore lacking psychic processes.[11]

Even if experiments since made by other investigators[12] had not proved the falsity of Bethe's conclusions, his attitude toward the subject would still be curiously contradictory from the naturalistic as well as from the logical standpoint, for the animal which did not learn with five experiences might give very definite signs of consciousness if it were given ten trials. Who is to fix the number of chances that the poor brute is to have to demonstrate its psychic processes?

These few instances of the working of the Bethe-Loeb criterion clearly indicate its fundamental weakness. It is absurd to say that it is of more value for us to discover that an animal does not perceptibly profit by a few experiences and from this conclude that it has no psychic life, than to discover by a thorough study of its behavior how its reactions are modified by often-repeated experiences, —in other words, in what manner and with what degree of rapidity it is able to profit by experience. Surely it is of vastly more importance for us to know how an animal learns than simply that it learns.

It is not enough to rest with pointing out the weaknesses of the criterion which has been most used. We must now ask ourselves what criteria and what method of application seem likely to yield the most valuable results for comparative psychology. To this question I should return the answer that is suggested by the classification of criteria that is presented at the beginning of this paper. In the study of the mental life of an animal no one of the six criteria, or however many there may be, should be used to the neglect of the others. In certain cases it may be best to apply each in turn, as was attempted in case of the sea anemone; in others it may be necessary to use only variableness, or modifiability and variableness. Each criterion has its own particular value, yet all are signs of psychic processes. It should be clearly understood that I do not in the least wish to suggest that these six criteria are the only ones pos-

[10] Bethe, 'Arch. f. mikr. Anat.,' 1898, LI., S. 447.

[11] 'Arch. f. d. ges. Physiol.,' 1898, LXX., S. 85.

[12] Yerkes, 'Biological Bulletin,' 1902, III., p. 241. Yerkes and Huggins, 'Harvard Psychological Studies,' 1903, I., p. 565. Fielde, 'Proc. Acad. Nat. Science of Phila.,' 1901, p. 529.

sible; on the contrary, there are probably much better ones still unthought of, which it is our task to discover and apply.

Undue emphasis of the structural criteria is unsafe and unprofitable, for it is likely to lead us to deny consciousness to animals which, although strikingly different in most ways from us, exhibit such complex forms of behavior, such complex modes of discrimination, adaptation, and communication that we can scarcely conceive of them as unconscious. Who shall say that the ant or bee has not a highly complex mental life? Certainly those who know them most intimately incline to ascribe to them psychic processes. All we can safely say then is, that the careful, systematic application of all available criteria, with good judgment and reasonable emphasis, may be expected to yield us the best available basis of inference from the physical to the psychic.

The problems of comparative psychology now appear to center about the course of the development of reactions, and the relations of the various types of activity. The genetic formula for reactions is the kind of description that makes strong appeal to all natural scientists. Too many of them, it must be admitted, seem to think it the only form of description possible. The evolution of activity is the all-engrossing subject. Action systems are rapidly being worked out for various animals, and the forms, relations and modifications of reactions are being studied with a minuteness that promises soon to put us in a position to trace with profit the course of the development of activity in the race as well as in the individual.

Meanwhile our criteria of consciousness are increasing in number, and our ability to use them is becoming greater by reason of increased knowledge of the facts of animal behavior. Perhaps when we succeed in ridding ourselves of certain prejudices that physical science fosters we shall agree with those who know the ant and bee most intimately. For may we not reasonably believe on the basis of just such signs as we have been discussing, that the ant with its complex organization, however different from ours, its highly developed and complexly differentiated nervous system, its manifold forms of sensory discrimination, its docility, and its extremely varied social life, possesses a form of consciousness which is comparable in complexity of aspect and change with the human?

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INFERRED CONSCIOUS STATES AND THE EQUALITY AXIOM

CONSCIOUSNESS is one of the topics just now at the forefront of discussion. Many motives are contributing to this, and psychologists and philosophers seem to be participating about equally in the interest aroused. Any inquiry is timely, therefore, I suppose, which offers its mite to the larger current of general discussion.

If the question were proposed whether it is justifiable to assume the existence of certain states of consciousness in spite of the fact that they elude the sharpest scrutiny of introspective experts, and if the advocates for and against were asked to stand forth for comparison of numbers, I suspect that the upholders of the affirmative would be surprisingly in evidence. Common sense, to be sure, favors the view that what we find in consciousness is the correct measure of what is really there. But logic sometimes prevails over the dictates of common sense, as indeed it seems often to have done in the case of this belief in unperceivable states of consciousness.

It is not my purpose here to defend this doctrine. Nor is it my intention to attempt any wholesale demonstration of its invalidity. I shall attempt merely to suggest certain reflections upon what I may, for convenience, name the Stumpf-Stout argument—reflections which, to my mind, discredit this argument and thus remove one of the strongest props to a belief in the existence of conscious states which are not merely undiscovered, but also forever *undiscoverable.*

First, let me remind you of the argument referred to. It is to be found, in substantially the same form, in Stumpf's 'Tonpsychologie' and Stout's 'Manual.' It is noteworthy, too, that Professor Stratton has recently reaffirmed the same position.[1] No injustice is done to the argument, I think, if it be stated in the following way: Suppose an instrument, capable of giving a continuous sound-stimulus of increasing vibration-rate. And suppose that the instrument be for the moment so adjusted as to give three successive sensations, S_1, S_2 and S_3, these sensations to be so related that, while S_1 is indistinguishable from S_2, and S_2, in turn, indistinguishable from S_3, S_1 and S_3, the extremes of the trio, may be clearly distinguished from each other. So far we have only the statement of an experimentally observable fact. But now comes the argument: since S_1, the first sensation, and S_3, the third sensation, are perceived as different, it

[1] Stumpf, 'Tonpsychologie,' I., pp. 33–34 and 352.
Stout, 'Manual of Psychology,' II., 1, 3, and II., 7, 2.
Stratton, 'Experimental Psychology,' Chap. V.

must be true that S_2, though apparently identical with both S_1 and S_3, is in reality different from them. For otherwise we should be confronted by the anomalous spectacle of two things unequal to each other and yet both equal to a third. The observed difference between S_1 and S_3 would be impossible, argues Stout, were not the change in the physical conditions accompanied throughout its entire course by a change in the sensation, and that, too, even though the change in the sensation be imperceptible. For (to slightly adapt Stout's language to the illustration that we are employing), 'if the pitch-sensation S_1 is regarded as identical with the pitch-sensation S_2, merely because the one note is indistinguishable from the other, and if in like manner S_2 is regarded as identical with S_3, then S_1 must be identical with S_3, and it would be impossible that any perceptible difference should ever arise.' Stout's argument is virtually a direct restatement of Stumpf's words.

The point of the argument is quite unmistakable. There is no obscurity about its meaning. While the physical sound-stimulus has been changing from the point corresponding to S_1 to the point corresponding to S_2, the sensation has been changing in appropriately parallel fashion. But this latter change has been unperceived. Indeed, says Stumpf, even with the highest possible degree of attentive scrutiny, it may remain unperceivable. And yet, notwithstanding the lack of direct observational evidence to the contrary, the inference is forced upon us, we are told, that actual differences in the sensations do exist.

This set of considerations is meant, of course, to extend to all departments of sense, and to apply alike to changing qualities and changing intensities.

Now, it is evident that this entire Stumpf-Stout argument for unperceivable states of consciousness rests upon the axiom that two things equal to a third are equal to each other; or rather, perhaps, upon a transformed statement of this, viz., that two things found unequal to each other can not actually be both equal to a third. And it seems to be a fair question to raise, whether we have any warrant for applying to the processes of consciousness an axiom primarily intended for use in mathematical thinking. But, before attempting to discuss this point, several preliminary comments suggest themselves.

In the first place, there is at least one experience similar in general character to that above related, where we seem to find no cause for stumbling in the fact that the axiom of equality does not apply. Two distances upon the surface of the hand are made equal to a third distance upon a neighboring area. Nevertheless, the two distances when compared with each other do not seem equal. But what

ground have we for expecting any other result? The matter is not one for *a priori* treatment, but for observation. Because the two cutaneous extents, though perceptually equal to the standard, are not equal to each other, shall we argue that the supposed equality to the standard is illusory, the actual, rationally demonstrable relation being rather that of inequality? Such reasoning would certainly be parallel to that above set forth in respect to the changes in sensation. Again, if the Stumpf-Stout argument is to hold in the realm of sensation-differences, should it not hold with equal force in the region below the stimulus threshold? Stout, in fact, maintains that it probably does so hold. But what degree of stimulus-intensity produces the first actual, though imperceptible, sensation? Does a sensation spring into existence as soon as any stimulus whatever reaches the sense organ? How is one to know? And how many such sensation-qualities and sensation-intensities may there be before something becomes discernible in consciousness? When we engage in these familiar speculations, we seem once more to catch the roar of Leibniz's waves upon the shore and to hear the feeding of Fechner's caterpillars in the forest.

Still further, and this time within the special region covered by the argument. An obvious corollary of the Stumpf-Stout doctrine is that the sensation on the conscious side is just as continuous as the sense stimulus on the physical side. The S_2 of the original illustration is not the only imperceptibly different sensation lying between the distinguishable S_1 and S_3. Consider the fact that the most practiced observers are unable to distinguish two sounds whose objective vibration-rates are respectively about 12,000 and 16,000. On the basis of the argument under consideration, these sensations must in reality be different. Yes, more than that. The note produced by 12,001 vibrations must be different from that given by 12,000, that produced by 12,002 vibrations different from that given by 12,001, and so on, making in all 4,000 unnoticed and unnoticeable sensations between these limits. But this is not all. Why suppose the changes in the physical stimulus to occur by steps of one vibration? Let the rate of change be by half-vibrations, quarter-vibrations, in fact by any fractional vibration-rate that the best conceivable instrument can produce. The number of sensations on the side of consciousness must keep pace with the fineness of difference that the stimulus is capable of exhibiting. The number of unperceivable sensations, therefore, that may find lodgment in our consciousness is practically limitless. Let the increase in any stimulus intensity be continuous and the sensation-changes are no less continuous. Only, our apprehension of these changes is so faulty that when we come to reflect upon the matter we seem to have a discrete series. Stout,

indeed, argues that, if the series were really thus discrete, 'the sensation ought to vary by leaps and bounds at certain fixed points'—leaps and bounds, I suppose, that would be apprehended as such. Now, of course, when we experience a series of intensities that proceed by steps of just observable difference, an outside observer who could watch the physical changes and the accompanying series of just observably different sensations would see the latter as discrete, as separated by gaps which on the physical side were filled. But to us who experience the series the perception of a just observable difference can hardly appear to be a leap over a gap.

But I suppose such hackneyed considerations as these have little weight in the face of the supposed logic of the situation. They may serve, however, in some fashion, to make clear the implications of the doctrine here in question. I must now try to show that the equality axiom is not to be employed in support of this doctrine except under qualifications which rob it of its power. Stated in formal fashion, the Stumpf-Stout argument reduces to this hypothetical syllogism:

If sensations S_1 and S_3 are each equal to S_2, S_1 must equal S_3. (For two things equal to a third are equal to each other).

But, S_1 does not equal S_3.

Therefore S_1 and S_3 are not equal to S_2.

But does the equality axiom, valid as it is in the sphere of mathematics, hold likewise in the realm of consciousness?

Obviously we should not be too ready to transplant an axiom from the home of its birth to alien territory. We should at least examine its right to survive, with unimpaired strength, in its new surroundings. And we may at once be made suspicious of any uncritical transplantation when we reflect that the meaning of equality for the mental life is, in its first intent at least, *felt* equality, whereas in mathematics we mean by equality a relation which holds good in utter disregard of subjective apprehensions of it.

But, however this may be, if the axiom in question is to retain its validity anywhere outside of mathematics, care should be taken to state the *respect in which* the equality is to be regarded, and the *conditions under which* the equality is known to obtain. The first requirement presents no difficulty when psychical states are in question, for the circumstances under which any comparison of such states is made are usually clear enough to obviate any confusion. The second requirement is the one that gives trouble. And yet it must certainly be met whenever the relation of equality is in question. For there is no *a priori* guarantee that an equality holding under one set of conditions will continue to hold when these condi-

tions have been changed. The equality between an American dollar and a particular number of German marks is maintained only when the conditions of the market are maintained also. All this is, of course, plain enough. But may it not be just here that grounds are to be found for criticizing the importation into psychology, without discussion, of a mathematical axiom. Completely stated the equality axiom should run: *Two things equal to a third under certain conditions are equal to each other,* PROVIDED THAT THE SAME CONDITIONS STILL PREVAIL. In mathematics the same conditions so obviously do prevail that they may be disregarded there in the statement of the axiom. 2×2 and $12/3$ are both equal to 4, and invariably equal to each other, because the numerical conditions under which these relationships hold are unchangeable. But when sensations or other conscious states are to be compared, it can by no means be assumed that their underlying conditions remain unaltered.

Take the familiar illustration once more. Who can assert that the cerebral conditions under which S_1 and S_2 are given and compared are identical with those under which S_1 and S_3 are given and compared? But until we know this and know it quite positively, we are not justified in making application of the axiom. It may well be that the physical stimuli of S_1 and S_2 are so little different that the cerebral states produced by them are the same. That nerve tissue offers resistance which some intensities and intensity-differences are unable to overcome seems to be an assumption not without warrant. Or, the very fact that the cerebral processes corresponding to S_1 are still in a state of partial excitement when the physical stimulus for the production of S_2 is given, may bring it about that this latter stimulus is unable, through inhibition or other causes, to produce the full cerebral and conscious effect that it would produce if given entirely alone. S_1 and S_3, on the contrary, may well be occasioned by physical stimuli sufficiently different to produce distinct cerebral commotions and, consequently, distinguishable conscious states. These are all trite observations. Of course our inability to make any exact statements about the conditions that prevail while sense stimulations are moving towards and reaching their cortical termini, places us often in embarrassment, and makes our suppositions too tentative for secure thinking. But, as the case stands here, are not the chances greater that we are in the presence of a brain fact rather than in the presence of a mystery of consciousness? And in our temporary uncertainty are we not doing better to place our hypotheses in a region where there is some hope of further enlightenment rather than in a region where the very circumstances of the case cut us off forever from the chances of investigation?

An illustration will serve best to sum up these considerations about the axiom. Let *A*, *B* and *C* be horizontal lines so drawn that *A* and *C* shall be the usual forms of the Müller-Lyer figure, with out-turned and in-turned arrows respectively, while *B* is a plain line. Let the adjustment of length be such that *A* and *C* are both perceived equal to *B*. But now strip *A* and *C* of their Müller-Lyer arrows and place them respectively between long and short parallel lines. *A* and *C* will no longer appear equal. That is, two lines perceived as equal to a third under certain conditions do not appear equal to each other under certain other conditions.

Now if this illustration fairly represents—and it seems to me that it does—the state of the case when qualities and intensities are to be compared, is there any possible reason for being overwhelmed with surprise at finding S_1 and S_3 equal to S_2 and yet not equal to each other? And, furthermore, is there any compulsory power that the equality axiom can wield over our thought in this instance, forcing us to conclude, as do Stumpf and Stout and the rest, that the reality is quite other than what our best endeavor can reveal? Rather, indeed, it seems to me, so confident ought we to be of the inapplicability of an unqualified statement of this axiom that we may feel assured that we are nearer the realities when we take our sensations to be what we find them to be, than we are when we take them to be what a dubious argument asserts that they *must* be.

A word in conclusion. It may be that unperceivable mental states exist. At any rate I do not wish here to deny them. But of two things I do feel fairly confident. First, it is my steadfast belief that if such states do exist they can be properly inferred only when some influence upon perceived conscious states is distinctly discernible. And, secondly, however the general fact may stand, I am entirely convinced that we are not under obligation to assume such states in order to avoid coming into contradiction with the equality axiom. And to set forth this last conclusion, together with the few reflections upon which it rests, is here my sole purpose.

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REVIEWS AND ABSTRACTS OF LITERATURE

Der Sociale Optimismus. LUDWIG STEIN. Jena, Hermann Costenoble, 1905, pp. 267.

This book, as we are informed in the preface, is a collection of essays which have appeared from time to time in the course of the last few years in periodicals and daily papers. There are twelve, as follows: (1) Social Optimism, (2) Social Ideas and Ideals, (3) Methods of Social

Restraint, (4) The Philosophy of the 'Middle Line' and the Parallelogram of Social Forces, (5) Menger's Popular Labor-State and Legal-Socialism, (6) Legal-Socialism and the Political Parties, (7) Social-Politics, (8) The Victory of Epistemological Pessimism, (9) Sociology on a Monistic Basis, (10) Mechanical and Organic Theories of the State, (11) Energetic Optimism, (12) The Fore-Shadowing of Optimism.

'Social Optimism' is the fourth of a series of recent publications by the author treating related topics. It emphasizes the social rather than the individual nature of optimism, and seeks to correlate material rather than to construct a system. Optimism has produced no such closed and firmly welded system as that of pessimism in the works of Schopenhauer and Hartmann. The purpose of the author is to present the problem of optimism in its various phases, and by a critical examination to distinctly differentiate similar and opposing views. Over four hundred different authors are quoted or referred to in the twelve essays.

The philosophical point of departure of 'Social Optimism' is the 'energic' world-view of Mach and Ostwald. "The attempt is made not only to establish 'Energic Monism,' theoretically, but also to answer its critics; announcing it as being of so transcendent a nature as to be subservient to no political party, nation, cult, or philosophy. Seen in the perspective of universal history, *sub specie æternitatis*, all of our political and religious oppositions, all importunate war cries and emphases of the important destiny of our day, shrivel to insignificance and nothingness. Starting with experience, with its eyes fixed upon social facts, having traced these to their psychological origins, 'Social Optimism' will illumine the way of humanity to social cosmos."

The essence of the optimistic creed is given in a quotation from the concluding words of Gustav Schmoller's recent work entitled 'An Outline of the Principles of Political Economy,' and reads: "The time will come when every good and normally developed man will know a suitable trade, and the attainment of individuality, self-esteem and the power of self-assertion will be coupled with righteousness and the highest public spirit. It is to be hoped that the journey is not so long as that which brought man from the condition of brute, physical strength to that of his present cultural state." As might be surmised from the number and diverse interests of the authors quoted, the essays are an invoice of the scientific, religious and philosophical concepts which have dominated the world-movements of the past. Running through the opposing and parallel opinions of the modern thinkers Dr. Stein finds the thread of monism; and between the idealism of Cohen and the materialism of Haeckel he finds room for what he regards as the more scientific concept of energic monism. Fichte is the real founder of this new dynamism. 'Social Optimism' and 'Energic Monism,' then, are resultant concepts of this inductive study, and not, as one might hope, the corner-stones of a newly completed structure. Their content, scientific, religious and philosophical, remains to be more clearly defined in terms of a new civilization which shall embody their inherent prophecy.

As a review of the trend of more recent thought the essays are both stimulating and instructive. The style is lucid and virile. While 'Pragmatism' and 'Instrumentalism' are nowhere mentioned by the author, they would, doubtless, both be included in the concept 'Energic Monism.'

ALBAN DAVID SORENSEN.

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The Vivisection Problem. (*A Reply.*) ALBERT LEFFINGWELL, M.D. *International Journal of Ethics,* January, 1905, pp. 221–231.

The matter of the controversy over vivisection is continually at the focus of public attention, and this alone would sufficiently account for a great deal of its puerile treatment. No other current question affords a more vivid illustration of the oscillations of thought. The almost exact balance maintained between approbation on the ground of utility and disapprobation on the ground of cruelty, producing much fluctuation of individual conviction, still keeps the public about evenly divided.

This article is written in reply to one entitled, 'Is Vivisection Justifiable?' by C. S. Myers, of Gonville and Caius College, Cambridge, published in the same journal, April, 1904.

Mr. Myers, who poses as an unprejudiced arbitrator having general acquaintance with the principles of ethics and psychology, registers an almost unqualified endorsement of the practice. He classifies the opponents of vivisection on moral grounds according to three standpoints, viz., the 'religious,' the 'common-sense' and the 'naturalistic.' The first considers that animals are placed in the world by the Divine Will and that man is their natural protector; it is an abuse of superior intelligence for man to inflict pain on them for any purpose whatever. The 'common-sense' antagonist, while opposing extreme cruelty, sanctions the infliction of a certain amount of pain upon animals, providing man's gain thereby is sufficiently great. The third standpoint, the 'naturalistic,' condemns vivisection not so much on account of the pain endured by the animals, as on account of the reflex effect which cruelty has upon man.

The arguments which Mr. Myers adduces in refutation of these respective positions are: that those who argue from the 'religious' standpoint are inconsistent when they sanction the slaughtering of cattle and the poisoning of vermin for the sake of increasing human comfort; that the 'common-sense' antagonist is ignorant of the great utility of vivisection; and that the 'naturalistic' view does not take into account the truth of 'multiple-personality' which means that, while a vivisector may be humane on all other points, sympathy would be positively detrimental to success at the operating-table.

This author cites the 'psychologist's fallacy' in refuting the charge of 'the sentimentalist' that vivisection involves the infliction of agony, saying that the cries and writhing of the animal-subjects are no criterion of true 'mental pain.' Besides, dogs have been observed to wag their tails and lick the hands of the operator, which evinces their indifference to the experiment.

He further considers it needless to discuss the utility of vivisection,

productive as it has been of such magnificent results in the study of microorganisms and the discovery of antitoxins. Typhoid and Mediterranean fever, diphtheria, tuberculosis in cattle and snake-bite have been sucessfully combated with remedies perfected through vivisectional experiments.

Dr. Leffingwell, himself a physician, is inclined to view the matter in another light. While laying no especial claim to knowledge of the principles of ethics and psychology, he doubts whether natural laws are to be discovered and human welfare promoted at the expense of animal agony. The question of *degree of pain* is one of some importance to him. He says, "The impeachment of unlimited vivisection rests wholly upon the conviction that in some of its phases it is productive of agony." The recognition of the value and moral legitimacy of definitely restricted vivisection should not blind one to the fact that, beyond certain limits, it becomes grossly immoral. "That vivisected animals sometimes suffer, is a charge that rests wholly upon the evidence of men who are neither 'sentimentalists' nor 'laymen,' but members of the medical profession. Speaking before the British Medical Association at its annual meeting in 1899, the President of one of the sections, Dr. George Wilson, LL.D., made this remarkable charge: 'I have not allied myself to the anti-vivisectionists, but *I accuse my profession of misleading the public as to the cruelties and horrors which are perpetrated on animal life. . . . Whether so-called toxins are injected under the skin, into the peritoneum, into the cranium, under the dura-mater, into the pleural cavity, into the veins, eyes, or other organs—and all these methods are ruthlessly practiced—there is long-drawn-out agony. The animal so innocently operated on may have to live days, weeks or months, with no anesthetic to assuage its sufferings, and nothing but death to relieve.*'"

Dr. Henry J. Bigelow, LL.D., for many years a professor in Harvard Medical School, says: "The ground for public supervision is that vivisection, immeasurably beyond any other pursuit, *involves the infliction of torture to little or no purpose.*"

Dr. Leffingwell tends to believe, in spite of the psychologist's fallacy, that Mr. Myers's citation of dogs having been observed to wag their tails and lick the hands of the operator, betokens, not a happy animal indifference to fate, but rather a mute, instinctive and vain appeal for sympathy.

Concerning the utility of vivisection, Dr. Leffingwell is by no means so sure as Mr. Myers. "Where are the proofs that the mortality from typhoid fever in any country has been reduced by the general use of the 'appropriate anti-toxin?' Where are we to look for similar evidence regarding mortality from Mediterranean or yellow fever? Has the mortality from snake-bite 'been diminished in any appreciable degree by the employment of a remedy regarding whose use we are assured there is hardly a failure on record?' If so where are the statistics? There are none. It is a claim of the laboratory."

Professor Hodge, of Clarke University, declared that "God clearly gives to man *every sanction to cause any amount of physical pain which he may find expedient to unravel His laws.*" Dr. Leffingwell, lacking the

necessary general acquaintance with the principles of ethics, can not accept this enunciation of the vivisector's creed, and marvels that God should hide facts and give torture the right to find them.

"What may we hope to accomplish in the reform of vivisection as it exists to-day? . . . It seems to us that, first of all, there must be the gradual creation of public sentiment which shall be eager, not so much to approve all vivisection, or to disapprove it all, as to know with certainty the facts. Take, for example, the question of vivisection in institutions of learning. To what extent is it carried on, merely to demonstrate what every student knows in advance? . . . *The removal of the secrecy that so generally enshrouds vivisection is the first and most important step toward any true reform.* [My italics.]

"And finally there must come the regulation of vivisection by law. . . . *The law ought to bring upon official records the number of experiments performed, the objects which were in view, the results which were attained, the species of animal upon which the investigations were made, the anesthetics which were administered, and everything that pertains to the prevention of pain.*" [My italics.]

This is a quite voluminous notice of Dr. Leffingwell's eleven-page article to take in this JOURNAL. I believe, however, that it is justified. Further, I would suggest that that article be copied verbatim by all magazines interested in the promotion of humanitarian principles. A more philosophic treatment of what has unfortunately become a very much confused subject, it has not been my fortune to discover; a more concise indication of the ends toward which reform should bend its energies has not yet appeared in print. I conceive that Dr. Leffingwell's reply, in the thoughts of all right-minded persons, will consign such ethical sophistries as are contained in Mr. Myers's paper to the limbo of eternal scorn. Vivisection, as a problem calling for immediate solution, does not demand 'a general knowledge of the principles of ethics and psychology'; it calls for a pragmatic acceptance of our direct intimations of its evils. "No one," says Goethe, "knows what he is doing while he acts aright, but of what is wrong we are always conscious." Those who, in this connection, subordinate the practical impulse toward the alleviation of animal woes to the logical demonstration of its validity, would do well to read Aristotle on the golden mean. Publicity and restriction, not total condemnation, is the key-note of Dr. Leffingwell's appeal, an appeal to which every one should lend support.

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The Soul—A Study of Past and Present Beliefs. L. D. ARNETT. *American Journal of Psychology,* April and July, 1904. Pp. 121–200, 347–382.

Ninety-one out of the one hundred and fourteen pages occupied by this study contain little more than the notes of a student summarizing his reading as he peruses the literature of the subject. The last twenty-three pages report the result of a questionnaire-study on the same topic.

The author states that he does not pretend to settle any disputed point

as to the nature of the soul, and that his intention has been merely to gather together information of which he felt the need. Had this work been offered as a finished history of the ideas that have been held concerning the soul, a long series of criticism would have to be made. In the present case, however, one may only thank the author for his painstaking and praiseworthy study. Its scope may be gathered from the following outline.

Mr. Arnett begins with the ideas of the soul entertained by non-civilized peoples (pp. 122–153). He deals with the influence of dreams, the various forms ascribed to the soul (birds, butterfly, mouse, serpent, lizard, etc.; the shadow, reflection; spirits, ghosts, etc.); the number of souls; its localization (in the blood, the bones, the breath, etc.). The different words used for soul by civilized and non-civilized peoples are given and, to some extent, discussed from the standpoint of philology.

The second part is a summary of the philosophical views (pp. 153–200 and 347–359). It begins with those of the Greek thinkers (pp. 153–164). The others are classified under three heads. (1) Theological ideas of the soul (neo-platonic doctrines, the Church Fathers, the scholastic philosophers and the opinions of the Church of to-day. Pp. 164–185). (2) Philosophical ideas (the views of those philosophers who have been relatively independent of religious beliefs. Pp. 185–200). (3) Psychological theories (the opinions of Descartes, Locke, Hume, J. S. Mill, Herbart, and of a few of our contemporaries. Pp. 347–359).

On pages 357 and 358 the author sketches, by way of conclusion, what appears to him to be the five successive steps in the genetic history of the soul:

1. The biological soul—the soul made coextensive with life itself. Extinct species represent the loss of so much of the *psyche*.

2. The phyletic, or race soul: the species regarded as a type of soul. Every animal is regarded as possessing a specific type of soul, that belonging to his species. The phyletic soul represents a differentiation of the biological soul.

3. The individual soul, *i. e.*, the type represented in the writings of Royce, Schiller, etc. It is a special form of the phyletic soul and is the result of heredity.

4. Personal consciousness—our individual experience.

5. Attention, *i. e.*, a cross-section of the present moment. It is the unity of apperception.

The study of the present ideas of the soul based upon the answers to a set of questions does not yield any very definite result. It is, however, interesting and valuable in that it gives precision and factual support to certain opinions.

The preponderant influence of religious teaching upon our ideas of the soul, and the difficulty with which psychological conclusions affect those beliefs have attracted the author's attention. Something in some way corresponding to the traditional notion of the soul seems to persist even in the consciousness of those who, under the influence of psychology, have theoretically discarded the 'soul.'

JAMES H. LEUBA.

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Ueber Fixation im Dämmerungssehen. RICHARD SIMON. *Zeitschr. für Psych. u. Physiol. d. Sinnesorgane.* Bd. 36, 1904. S. 186–193.

The author finds that each eye has a definite, habitual way of fixing peripherally a small point in a black field, which is so faintly illuminated as to be invisible on the fovea, although visible on the surrounding region. Thus in one subject the left eye regularly fixed the stimulus by means of a point directly over the fovea, while the right eye received the stimulation on a point above and to the temporal side of the fovea. When the eyes came to these positions involuntarily there was no 'feeling of fixation'; but it was possible voluntarily to fix the faint stimulus in several peripheral positions, and in that case also there was no more 'feeling of fixation' than there is 'when the unadapted eye sees an object in indirect vision.' The degree of adaptation of the eye affects the position of fixation which it automatically assumes; the unadapted eye comes to lie so that the faint stimulus falls several degrees away from the fovea, but with increasing adaptation this point approaches the fovea. Intensity of stimulus (always below the foveal threshold) has the same effect as adaptation.

The foveally invisible dot can not be fixed perfectly. "True nystagmus is not present; but a certain quivering of the object fixed easily happens, and this in all probability depends on slight involuntary eye movements, to be explained because it is much harder to maintain perfect fixation on parafoveal points of the retina than on the fovea." Such hyperphorias of the eyes when the field is dimly illuminated considerably interfere with the stereoscopic vision that Nagel has shown to be possible for the adapted eyes, and with illuminations under the foveal threshold.

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Zur Kenntnis des zentralen Sehaktes. SIGMUND EXNER. *Zeitschrift für Psychologie und Physiologie der Sinnesorgane,* Bd. 36, 1904. S. 194–212.

'The occasion for this is offered by the new and valuable discoveries of Hitzig, and a related series of experimental results recently obtained by Shinkichi Imamura.' If in the dog all the visual fibres that go to the occipital lobe of one side are destroyed, there results a double homonymous hemiamblyopia of the same side of the visual field; this may be demonstrated by the 'sausage perimeter,' in which the animal standing before a row of sausages consents to eat all that he sees. Almost the same visual disturbance is brought about by extirpating a portion of the cortex in the motor (frontal) region. Now E. Hitzig found in 1900 that when a dog had recovered from the hemiamblyopia due to the occipital operation, the frontal operation would produce no renewal of the amblyopia; and conversely, if most of the motor region was first removed, and, after the animal had recovered, a part of the occipital, the amblyopia would not reappear. 'The extirpation of the motor cortical area had apparently made the animal immune to any hemiamblyopia that might be expected

from a lesion of the visual lobes of the same side.' But if the first operation was in the occipital lobe of one side and the second in the same region of the other side, the hemiamblyopia of the first operation would be reestablished by the second. H. Munk contested Hitzig's results, but Imamura has now confirmed them.

Exner proposes, in explanation of these phenomena, that, after extirpation of the fibres to the occipital lobe, fibres of the corpus callosum supply the requisite afferent currents from the other side of the brain. This would particularly well explain the return of amblyopia after operation of the second occipital lobe. The suggestion is in so far confirmed that Imamura found that if, after an animal had recovered from an operation on one visual lobe, he then severed the callosal fibres, the amblyopia returned *and was now permanent.* But Exner's explanation seems not to account for the fact that, after recovery from operation of the motor or visual region, an operation of the other of those regions (on the same side) brought no return of the disturbance to vision. The paper includes minor details, specially regarding alternating hemiamblyopia, and an instructive discussion of the physiology of consciousness—this last quite in the vein of the venerable author's '*Entwurf.*'

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JOURNALS AND NEW BOOKS

AMERICAN JOURNAL OF PSYCHOLOGY. January, 1905, Vol. 16, No. 1. *The Psychology of Dreams* (pp. 1–34): J. R. JEWELL.– A questionnaire study based on replies from 800 normal-school students and some dream diaries, in which the replies and the literature on dreams are well used. Sixteen deductions are given; one is indicative: 'There is no mode of functioning of the mind in the waking state that may not take place during sleep.' *Psychology of Æsthetics* (pp. 35–118): L. J. MARTIN.– This article is a report of some 'experimental prospecting in the field of the comic.' Ingenious modifications of some of the well-known psycho-physical methods are used to secure effects of comic pictures on five or six observers. A questionary was also used with these same observers and a report of their choice of historical theories of the comic is given. *Primitive Hearing and Hearing-words* (pp. 119–130): A. F. CHAMBERLIN.– A brief statement of the acuteness of hearing among primitive peoples, and of the words used in various languages to describe the phenomena of hearing. *Memory of a Complex Skillful Act* (pp. 131–133): E. J. SWIFT.– After two years of intermission two subjects take up a former practice exercise to determine the efficiency of skill after the long rest. The results show no appreciable loss of skill and the subjects report only a temporary fatigue as interfering with the execution of the series of ball-tossing. *Literature. Notes.*

THE PSYCHOLOGICAL REVIEW. January, 1905, N.S., Vol. XII., No. 1. *The Experience of Activity* (pp. 1–17): WILLIAM JAMES. – President's address before the American Psychological Association, Philadelphia Meeting, December, 1904. An abstract of the address appears in Vol. II., No. 3, of this JOURNAL, on page 58. *The Relation of Perceptive and Revived Mental Material as Shown by the Subjective Control of Visual After-images* (pp. 18–40): TH. H. HAINES and J. C. WILLIAMS. – This article adduces experimental evidence of the interference of the memory image or voluntarily aroused subjective color impression with the after-image. The explanation of the phenomena is sought in the efferent fibers of the optic nerve. *The Effect of Verbal Suggestion upon the Estimation of Linear Magnitudes* (pp. 41–49): JOSEPH E. BRAND. – Certain purely arbitrary suggestions of possible errors of estimation appear in general to have a positive influence upon the subject's estimation of magnitude. *Experiments on the Unreflective Ideas of Men and Women* (pp. 50–66): GENEVIEVE SAVAGE MANCHESTER. – The author has repeated the earlier study of Professor Jastrow of the 'Surface' or unreflective ideas of men and women students, as preliminary to a study of the mental differences of the sexes.

REVUE DE PHILOSOPHIE. December, 1904. *L'Atmosphère métaphysique des Sciences naturelles, I.* (pp. 693–711): P. VIGNON. – A scientific philosophy is analytic monism (mechanism) or synthetic monism (pantheism) or theism. The first can not explain correctness of thought, the second neglects the diverse scientific methods and individual differences. The third is the presupposition of all science which implies an original productive force. *La Théorie Physique, II.: La Structure de la Théorie Physique* (pp. 712–737): P. DUHEM. – A physical experiment is not only observation but interpretation, resulting in an abstract symbolic judgment. Only symbolism renders possible the use of instruments. Testimony in non-scientific matters is surer and simpler than, but not so detailed or precise as that in scientific subjects. *Les Notions infini et de parfait* (pp. 738–757): CH. HUIT. – Up to and including Aristotle these notions were distinct; in Plotinus they were identified, though the infinite was also used to signify the negative property of unlimitedness (*à suivre*). *Revue critique de Sociologie* (pp. 758–764): G. DE PASCAL. – Sociology as at present understood is too wide, has not defined its object and method clearly. Its terminology also is obscure and somewhat pedantic. *A propos d'un Livre recent* (pp. 765–770): J. GRASSET. – A recent anonymous book, *Les Conflits de la Science et des Idées modernes,* defends religion without hostility to science. Science is non-moral and can not defend or refute religion, which states the ideal. *Discussion sur l'Abstraction* (pp. 771–784): V. BERNIES ET J. GARDAIR. Analyses et Comptes Rendus: C. Labeyrie, *Dogme et Métaphysique:* A. B. J. Serre, *Ernest Hello: L'Homme, le Penseur, l'Écrivain:* T. DE VISAN. L. Roure, *Hippolyte Taine:* E. NUSBAUMER. *Études sur la Philosophie morale au XIX^e siècle:* F. M. W. R. Paterson, *L'Éternal Conflit (tr. de l'anglais):* F. M. *L'Année sociologique:* G. P. A. Castelein, *Droit Naturel:* G. DE

PASCAL. L. de Contenson, *Syndicate-Mutualités-Retraites:* G. P. J. E. Fidao, *Le Droit des Humbles, Études de Politique sociale:* G. DE PASCAL. G. Lechalas, *Introduction à la Géométrie générale:* S. J. DELAPORTES. *Cours de M. Bergson au Collège de France. Cours de M. Sertillanges. L'Enseignement de la Philosophie dans les Universités. Nominations dans l'Université.* Nécrologie.

REVUE DE PHILOSOPHIE. January, 1905. *La Pensée philosophique et la Pensée mathématique, I.* (pp. 5–24): X. MOISANT. – Present emulation of mathematics by philosophy is vicious. Mathematics is due to the work of the imagination upon selected representations and is divorced from the reality which philosophy studies. Mathematics, describing in static terms, can not lay hold of the real which is changing, dynamic. Again, it describes in detail, by parts, while philosophy looks not for analysis so much as for synthesis, for a view of the whole system of reality. *La Théorie physique: La .Loi physique* (pp. 25–43): P. DUHEM. – Physical laws are relations between symbols, whose meaning depends on one's accepting a whole group of theories. They are neither true nor false, but are approximations, provisory, relative to our point of view. This is due to their symbolic character. *Un Chapitre de l'Histoire de la Métaphysique: les notions d'infini et de parfait (suite et fin)* (pp. 44–66): CH. HUIT. – The lesson of the development of these ideas from Jewish theology and the medieval church to the present is that they belong together. The perfect is the only true infinite. The mathematical infinite is only the indefinite. God contains the fusion of the two ideas. *Revue critique: Doctrines et opinions relatives à la Philosophie biologique, I.* (pp. 67–93): P. VIGNON. – A summary account of recent biological-philosophical literature. *Discussion sur l'Abstraction* (pp. 94–98): CTE. DE VORGES. Sommaire des Revues. Analyses et Comptes Rendus: A. Réville, *Histoire du Dogme de la Divinité de Jésus-Christ:* J. V. BAINVEL. G. H. Luquet, *Aristote et l'Université de Paris pendant le XIIIe Siècle:* CH. HUIT. J. Payot, *La Croyance, sa Nature, son Mécanisme, son Education:* C. LABEYRIE. *L'Education de la Démocratie, Enseignement et Démocratie, L'Education fondée sur la Science:* T. DE VISAN. G. Noblemaire, *Concordat ou Séparation:* R. DUVAL. A. Dufourcq, *La Pensée chrétiennen. Textes et Études. Les Saints. Saint Iréné:* P. DUHEM. Mgr. Le Camus, *Fausse Exégèse, manuvaise Théologie:* A. B. *Bulletin de l'Enseignement philosophique. L'Enseignement philosophique au Collège de France.* Nécrologie.

JOURNAL DE PSYCHOLOGIE, NORMALE ET PATHOLOGIQUE. January–February, 1905, Vol. 2, No. 1. *Aphasie motrice à répétition chez une morphinomane* (pp. 1–15): ROY ET JAQUELIER. – A woman of sixty-one years, who had been addicted to the morphine habit for twenty-eight years, was found to suffer both loss of speech and ability to write even her own name from a copy. No lesion of any kind was found. After two months' treatment the defects both disappeared entirely. The authors claim this the first case of its kind on record. *Psy-*

chologie comparée de quelques manifestations motrices, communément designées sous le nom de 'tics' (pp. 16–41): ANDRÉ LALANDE. – The author makes a plea for more exact definition. Of the phenomenon designated by the name 'tic,' such normal habits as tapping one's finger when in deep thought, as well as the automatic rhythmical movements of idiots, should be excluded from the content of the term. From a psychological point of view, 'tic' can apply only to the reflex bulbar manifestations in psychasthenia. *Notes and Discussions. Documents et remarques sur la conscience des mots dans la langage* (pp. 37–41): ANDRÉ LALANDE. – "Language is then not formed of the words in the consciousness of those who employ it any more than a melody is formed of the notes first thought out individually, which compose it." Revue des périodique: psychologie normale (pp. 42–75); psychologie pathologique (76–96).

ZEITSCHRIFT FUR PSYCHOLOGIE UND PHYSIOLOGIE DER SINNESORGANE. October, 1904, Band 36, Heft 4. *Ein Beitrag über die sogenannten Vergleichungen übermerklicher Empfindungsunterschiede* (pp. 241–268): JOS. FRÖBES, S.J. – Experiments on lifted weights by method of constant stimuli to analyze factors which influence estimates. Results and introspective notes show that absolute impression of variable stimulus largely determines judgment. *Untersuchungen über die akustische Unterschiedsempfindlichkeit und die Gültigkeit des Weber-Fechnerschen Gesetzes bei normalen Zuständen, Psychosen und functionellen Neurosen* (pp. 269–293): G. A. HOEFFER. – The discriminativeness for differences in sound intensities is approximately constant for both normal and abnormal persons. In only two out of twenty patients suffering with various forms of mental disease was the absolute sensible discrimination subnormal. *Untersuchungen über den galvanischen Lichtreflex* (pp. 294–295): DR. BUMKE. – Investigation of the relation between the optical and pupillimotor effect of the galvanic stimulus. Experiments on fatigued eyes show that the light sensitivity in the state of exhaustion is increased while the reflex sensitivity is decreased very markedly. Literaturbericht.

ZEITSCHRIFT FÜR PSYCHOLOGIE UND PHYSIOLOGIE DER SINNESORGANE. December, 1904, Band 36, Heft 5 u. 6. *Eine Enquête über Depersonalisation und 'Fausse Reconnaissance'* (pp. 321–343): G. HEYMANS. – Result of this questionnaire study seems to justify the conclusion that there are two types, in one of which these phenomena occur markedly more often, in the other as markedly less often than the average. The first type is characterized by strong emotional temperament, uneven temper, tendency to spasmodic effort and little aptitude for mathematics; the other evenness of temper, regularity and little aptitude for languages. Explanation of phenomena is to be sought in temporary relaxation of attention. *Ein Beitrag über die sogenannten Vergleichungen über merklicher Empfindungsuntershiede. Zweiter Teil* (pp. 344–380): JOS. FRÖBES, S.J. – A repetition of Ament's experiments on light intensities. The surprising result was obtained for high intensities that the variable stimulus B,

adjusted between A and C, far exceeded the arithmetical mean. This is attributed to the fact that the judgment is determined largely by the brightest disk which tends to claim the attention. *Über die Methode der Kunstphilosophie* (pp. 381–416): KONRAD LANGE. – A criticism of the logical method of Tolstoi, Laurila and Volkert and their emphasis upon the ethical in art. The experimental method is insufficient. The historical method, with emphasis upon the evolutionary point of view, is advocated. *Über Assoziationsreaktionen, die auf optische Reizworte erfolgen* (pp. 417–430): HENRY J. WYATT. – General tendency to form associations with words of the same class shown. In three observers the constant tendency was to make the associations with words of different class; in the remaining five as uniformly with words of same class. *Über monokulares körperliches Sehen nebst Beschreibung eines als monokulares Stereoskopbenutzten Stroboskopes* (pp. 431–439): M. STRAUB. – It is maintained that there is no real difference between monocular and binocular perception of depth, hence the importance of a study of monocular stereoscopy for the theory of vision. Both depend on the parallax. *Zwei akustische Demonstrationen* (pp. 440–445): A. SAMOJLOFF. – (1) A stroboscopic analyzer to demonstrate overtones. (2) The violin as an acoustic instrument demonstrated by placing a small mirror on the bridge and its reflection thrown on a screen. Literaturbericht.

ZEITSCHRIFT FÜR PHILOSOPHIE UND PHILOSOPHISCHE KRITIK. November, 1904. Band 125, Heft 1. *Zu Kuno Fischers 80. Geburtstage* (p. 1): R. FALCKENBERG. *Die Psychologie des Joh. Bapt. van Helmont in ihren Grundlagen* (pp. 2–15): F. STRUNZ. – This experimental scientist maintained that knowledge of one's own soul precedes and is more sure than that of bodies. He distinguishes the insight, will and love of the spirit from that of the sensible soul in that the former perceives and acts and feels without sense or bodily exercise. *Die Idealität der ästhetischen Gefühle* (pp. 15–33): ANNA TUMARKIN. – By ideality those following Schiller have meant serenity; it should mean separation from practical life. Esthetic feeling is not serene. Esthetic sensibility is cultivated only through loss of practical power. *Bericht über die Erscheinungen der Französischen philosophischen Litteratur der Jahre 1900 bis 1901* (pp. 33–47): E. DUTOIT. – Special attention is paid to Couturat's 'La logique de Leibnitz,' and Renouvier's 'Les dilemnes de la métaphysique pure.' *Ethik des Mitleids* (pp. 47–53): H. SCHMIDKUNZ. *Sittlichkeit und Kultur* (pp. 53–68): B. BAUCH. – The moral worth of the good will must be transferred to the struggle of mankind with itself towards the ideal virtue, though that struggle does not necessarily imply exercise of the good will, for in it alone can the good will find exercise. The teleological judgment of conduct concerns culture and not morality proper. *Recensionen* (pp. 69–107). J. Bergmann, *Untersuchungen über Hauptpunkte der Philosophie:* WALTER. E. Wentscher, *Das Kausalproblem in Lotzes Philosophie:* R. FALCKENBERG. O. Kraus, *Zur Theorie des Wertes:* H. SCHWARTZ. G. Wobbermin, *Theologie u. Metaphysik:* T. ELSENHAUS. H. Vaihinger, *Nietzsche als Philosoph:* P. SCHWARTZ-

KOPF. Th. Lipps, *Vom Fühlen Wollen und Denken:* v. ASTER. E. Marcus, *Kants Revolutionsprinzip:* O. SCHÖNDÖRFER. L. W. Stern, *Zur Psychologie der Aussage:* O. KOWALEWSKI. Fr. Jodl, *Lehrbuch der Psychologie:* ZIEHEN. F. Paulsen, *Philosophia militans:* E. PFENNIGSDORF. Ossip-Lourié, *La philosophie russe contemporaine:* W. v. TSCHISCH. W. Hellpach, *Die Grenzwissenschaften der Psychologie:* M. ISSERLIN. *Notices. New Books.*

ANNALEN DER NATURPHILOSOPHIE. November, 1904. Band 4, Heft 1. *Zur Theorie der Wissenschaft* (pp. 1–28): W. OSTWALD. – From a survey of the sciences, which are grouped under the divisions of Mathematics, Energetics and Biology, it is found that the development of each science is the formation and interrelation of concepts through certain abstractions from experience, the relations being either rules or laws. The next step in scientific development is to make the process of discovery itself systematic. *Ueber das Studium der Sprachkurven* (pp. 28–47): E. W. SCRIPTURE. – Emphasis is laid on the great possibilities in scientific discovery as well as in matters of more general interest that lie in the acoustographic instruments. Four fundamental principles of a theory of the voice are advanced. A method is given for detecting the melody in the smallest intervals of speech. *Neo-Vitalismus in der modernen Biologie* (pp. 47–102): W. BIEGANSKI. – The course of both the mechanical and the vitalistic ideas in biology is traced from the days of Greek science to the present, leading to the complete dominion of the mechanical (about 1842) and the vitalistic reaction brought about by Lange and Schopenhauer. Vitalism rests on an idealistic epistemology; mechanism on an empirical. Modern vitalism does not differ fundamentally from the old. Mechanism is true as a method, not as an epistemological theory. *Aus dem kristallographisch-chemischen Grenzgebiet* (pp. 102–115): v. GOLDSCHMIDT. – Illustrations of the method of determining the form of crystal formation through examining the work of acids and solvents on crystalline spheres. *Das Duale System der Harmonie* (pp. 116–136): A. v. OETTINGEN. – The distinction between acoustic and musical consonance is made, and a technical discussion with Stumpf on the subject follows. The dual system is distinct from Helmholtz's explanation of harmony. *Neue Bücher:* Reviews by W. O., including the following: K. Heim, *Psychologismus oder Antipsychologismus.* A. Höfler, *Abhandlungen zur Didaktik und Philosophie der Naturwissenschaft, II., Zur Gegenwärtigen Philosophie.* P. H. Siewers, *Mechanismus und Organismus.* H. de Vries, *Befruchtung und Bastardierung.* A. Stöhr, *Zur Philosophie des Uratomes und des Energetischen Weltbildes.* H. Friedmann, *Die Konvergenz der Organismen.* L. Volkmann, *Grenzen der Künste.* L. Volkmann, *Naturprodukt und Kunstwerk.* G. Fischer, *Die Theorie der direkten Anpassung und ihre Bedeutung für das Anpassungs- und Descendenzproblem.* M. Verworn, *Naturwissenschaft und Weltanschauung.*

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University of California Publications. *Philosophy.* Studies in Philosophy prepared in commemoration of the seventieth birthday of Professor George Holmes Howison. Contributions by E. B. McGilvary, S. E. Mezes, G. M. Stratton, C. H. Rieber, C. M. Bakewell, E. N. Henderson, J. D. Burks, A. O. Lovejoy, H. W. Stuart, T. de Lopez de Laguna, K. Dunlap, H. A. Overstreet. Berkely: The University Press. 1904. Large 8vo. Pp. 262.

NOTES AND NEWS

To perpetuate the memory of C. L. Herrick in the scientific world and among the friends of Denison University, and as a tribute of gratitude for his services, the Denison Scientific Association has appointed a committee to secure a fund to be known as 'The C. L. Herrick Memorial Fund.' The first purpose of the committee is to secure for Denison University Dr. Herrick's scientific library, which his family is obliged to dispose of. It is hoped, however, that only a portion of the fund will be used in procuring the library and that an adequate principal may be set aside, the income of which will be available in maintaining the serials represented in the library and in otherwise fostering the interests of science. A friend of the institution has promised to duplicate all subscriptions made for this purpose before July first next. Subscriptions may be sent to Professor Frank Carney, Denison, Ohio.

M. Henri Bergson has been appointed professor of modern philosophy in the Collège de France, to succeed the late Gabriel Tarde.